Project Introduction

Redundancy is a powerful technique for achieving high levels of Single Event Upset (SEU) tolerance when utilizing commercial technology. While the multiple CPU cores boost performance by operating in parallel, they also can operate redundantly in order to maximize tolerance to SEUs. This approach requires a software framework to configure and operate the redundant system. In this proposed effort, Innoflight will develop a Software Redundancy Framework (SRF) for Commercial Off-The-Shelf (COTS) Multi-core System-on-Chip (SoC) Field Programmable Gate Arrays (FPGAs). The SRF is an IP core on an FPGA and associated software modules offering an elegant suite of targeted mitigations for SEUs, thus enabling COTS hardware to bring its superior SWaP to demanding radiation environments for the first time. We will examine the SRF: (a) initially with single-threaded user applications; (b) then with multithreaded applications; (c) testing with prototype hardware including under proton single event effects (SEE) testing; and (d) finally a potential flight demonstration on the ICE-Cap mission slated for launch in 2015. At the end of Phase II, Innoflight will have a complete framework that is ready for implementation on operational space computing platforms

Primary U.S. Work Locations and Key Partners
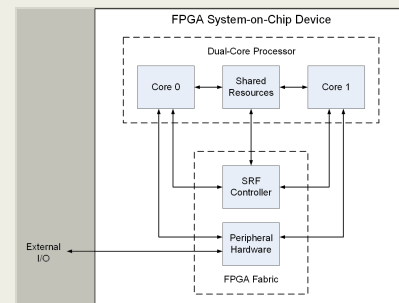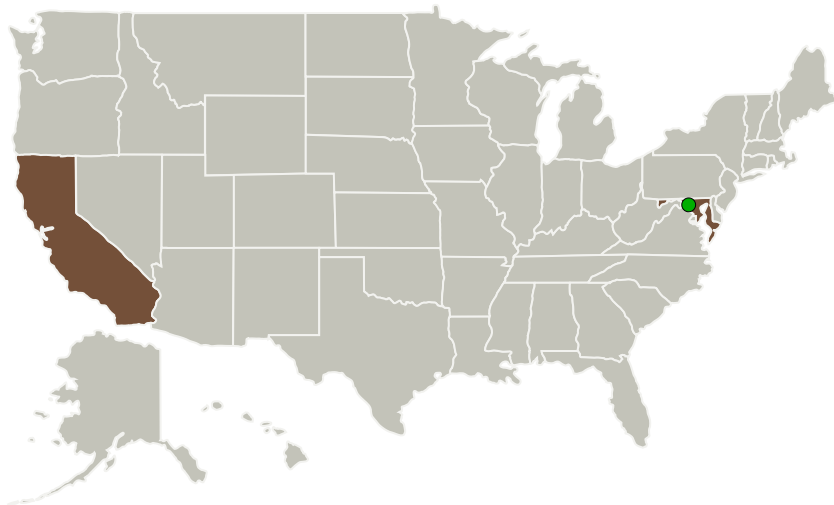

Software Redundancy Framework for COTS SoC FPGAs, Phase I

Table of Contents

Organizations Performing Work	Role	Type	Location
Innoflight, Inc.	Lead Organization	Industry Veteran-Owned Small Business (VOSB)	San Diego, California
🟢 Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

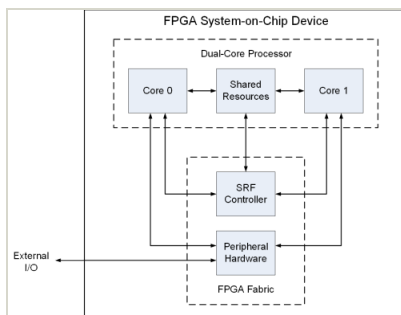| Primary U.S. Work Locations	
California	Maryland

Project Transitions

▶ **June 2015:** Project Start

✔ **December 2015:** Closed out

Closeout Summary: Software Redundancy Framework for COTS SoC FPGAs, Phase I Project Image

Closeout Documentation:
- Final Summary Chart Image*(https://techport.nasa.gov/file/139472)*

Images

Briefing Chart Image
Software Redundancy Framework for COTS SoC FPGAs, Phase I
(https://techport.nasa.gov/image/129168)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Innoflight, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
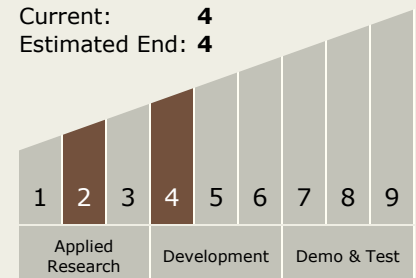Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jonathan Wolff

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.2 Avionics Systems and Subsystems
    - TX02.2.8 Use of Advanced Commercial-off-the-Shelf (COTS) Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System